

AN ORDINANCE relating to Steep Slopes
establishing county open space policies;
amending the Comprehensive Plan for King
County under the provisions of Ordinance
263, Article 2 Section 3 and KCC 20.12.030.

BE IT ORDAINED BY THE COUNCIL OF KING COUNTY:

SECTION I. NEW SECTION. "Steep Slopes as Open Space,"

attached hereto is hereby adopted as an addendum to the Compre-
hensive Plan for King County. As an amplification and augmen-
tation of the Comprehensive Plan, the Steep Slope Open Space
element shall supplement Chapter E, Open Space Development
Policies, and shall prevail where conflicts, if any, may occur.

INTRODUCED AND READ for the first time this 2nd day of
April, 1973.

PASSED this 4th day of June, 1973.

KING COUNTY COUNCIL
KING COUNTY, WASHINGTON

John T. O'Brien
Chairman

ATTEST:

Deputy

Dorothy M. Owens
Administrator-Clerk
King County Council

APPROVED this 6th day of June, 1973.

John J. Spillman
King County Executive

King County. In this section we are concerned with the character, distribution, and future disposition of these lands in western King County rather than within the mountain foothills and rugged peaks of the Cascade Range in the eastern portion of the County which are treated in another section of the report.

Steep slopes are broadly distributed throughout the County, with every section having its share. It is estimated that approximately 9% of the total land area of western King County, approximately 50,000 acres, is in lands that exceed a 25% slope.¹

Usually attractively wooded, steep slopes and ravines form the natural greenbelts of the County, lands that have been by-passed for development except where views and proximity have combined to make them economically valuable and salable. Located as they are along river and stream valleys, marine

¹Measurements made by King County Department of Planning from U.S. Geological Survey Maps at 1"=1 mile scale on which steep slope lands have been depicted. Many sources accept 25% slope as a degree of steepness beyond which building density should be limited and structural design controlled. See: Michael J. Meskenberg, Environmental Planning: 1. Environmental Information for Policy Formulation, Planning Advisory Service Report No. 263, November, 1970. American Society of Planning Officials, 1313 East 60th Street, Chicago, Illinois.

scouring and deposition of materials and of the gradual carving of river and stream valleys by waterways flowing toward Puget Sound. These same geologic processes have created natural conditions which make many of these areas subject to landslide, slippage, erosion and seismic hazard. When developed, this potential hazard is transmitted to life and property, often at public as well as private expense. There is also an impact on surrounding properties when steep slopes are denuded, scarred and developed.

In the following pages, trends and problems in regard to development of steep slope areas are discussed as well as the values of retaining these areas in the open space system.

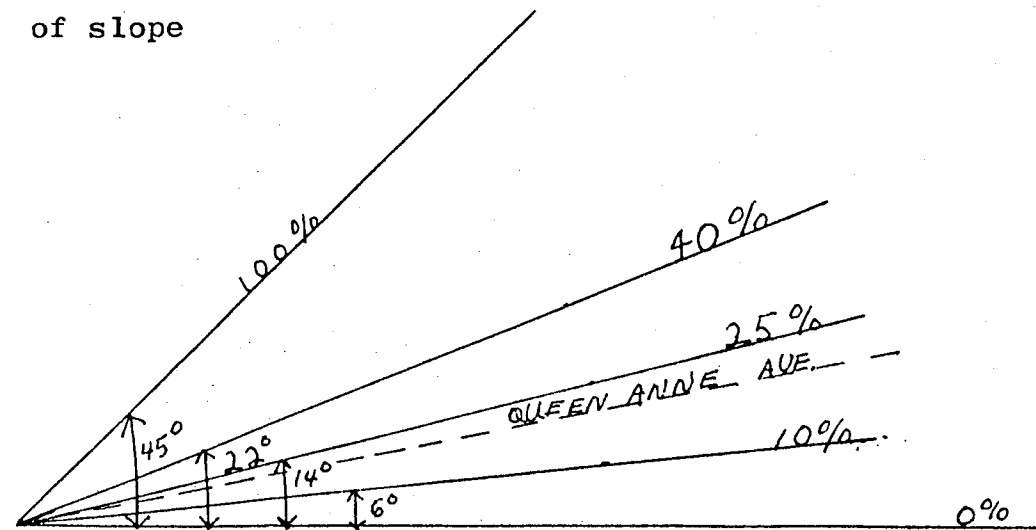
DEFINITION

Steep slopes consist of all lands over 25% slope, and those lands under 25% slope which represent a potential hazard to development by reason of soil erosion, landslide, sedimentation, or other reason; together with related ravines and narrow benches located within or immediately adjacent to these slope areas.

This definition broadly includes those lands which should be examined for their open space value as well as potential

For illustrative purposes, the diagram below shows a profile of several types of slopes and expresses them also in degrees (another way of describing a slope). In order to relate these slopes to specific examples, the City of Seattle Engineering Department states that the steepest street in Seattle (East Roy Street between 25th North and 26th North) has a 26.04% slope, James Street between Fourth and Fifth Avenues is 18.3% slope and Queen Anne Avenue between prospect Street and Highland Drive is 18.5% slope. In general, construction of streets or sidewalks on a greater than 10% slope is not considered desirable.

Percent and Degree
of slope



development, however, as suitable urban land becomes scarce, as taxes increase, and as the amenity value of view, exposure, or vegetative cover becomes more desirable. Sample studies in the Puget Sound Region show that density of development decreases as slope increases,² thus reflecting the greater difficulty and expense of constructing homes on steep slope sites. Furthermore, the factor of landslide hazard, where this is known and documented, becomes an inhibiting factor to development.

Improvements in technology have allowed building to take place on sites which apparently were not previously considered suitable or economically feasible for development. Innovative site and building design has often produced imaginative solutions that are architecturally pleasing and a tribute to engineering capabilities. All too often, however, irresponsible claims made by developers often have proven to be groundless in the face of later disaster.

Changing life styles have produced a certain clientele that places uniqueness, view, privacy or other amenities on a high value scale in relationship to economics. This

²Project Open Space Report No. 9, Areas of Steep Slope in the Central Puget Sound Region, Puget Sound Governmental Conference, November, 1964.

back riding and bicycling, has produced a renewed examination of steep slope areas that can be acquired or utilized for these purposes.

PROBLEMS IN REGARD TO DEVELOPMENT OF STEEP SLOPES

Certainly, one of the most important factors that mitigates against development on steep slopes is the degree of steepness. Rarely are slopes over 40% built on, and most sources recommend against any development on slopes of over 25% unless it is highly regulated and engineered and of very low density.³ The Soil Conservation Service of the U.S. Department of Agriculture reports that, in King County, most soils on 25% to 40% slopes have both a severe soil erosion and a landslide hazard, with Kitsap soils having a severe hazard down to 15% slopes.

Soil maps are a useful device for determining both landslide and erosion hazard. With the recent completion of an up-to-date soil survey for most of western King County by the Soil Conservation Service, sufficient data is now available in map and preliminary report form for determining those areas within which appropriate additional investigation and

³Op cit. Meskenberg

The problems of potential landslide and erosion may not be known to the uninformed and, indeed, may not even become a problem as long as the natural environment is not disturbed. Under natural conditions, soils of the steep slopes have benefited from the protective cover of trees, shrubs, mosses, grasses and the accumulation of plant remains. Root masses help further to protect the soil from erosion and slippage. The present state of soil protection has been achieved through many years of plant succession and development and can easily be nullified by man's activities. However, some soils may be subject to land slides and soil slips even without man's interference. Such soil movement will occur as a result of natural processes without warning and even where no potential problems appear to exist.

The recent winter of 1971-72 produced a number of problems for the County and homeowners. Slides occurred in many

⁴ Hazard ratings based on Soil Conservation Service data as mapped by King County Department of Planning at a scale of 1"=1 mile. Severe landslide hazard includes KpD and AkF Soils; severe to very severe erosion hazard includes Agd, AkF, BeD, BeF, KpD, RaD, RdE, and Rh Soils. See appendix for description of the above soils.

its emergency program which became effective in mid-October of 1972. This program allows an owner of an existing structure within either a slide or flood zone to apply for subsidized federal insurance up to a designated amount, which will reimburse his loss in case of property damage due to a mud slide or flooding.⁵

A related problem exists when people construct homes on level benches within or adjacent to a slope area which then are subject to soil slippage which penetrates the bench area. Many examples of property damage have occurred along Alki Avenue in Seattle where such a situation exists.

The indiscriminate filling of ravines without providing for the natural drainage function of that ravine can create serious erosion problems as the drainage water tries to find a new route or return to its original path. Subsidence of the fill area may result, or the infiltration of water

⁵ Further information on this program and maps showing eligible areas can be obtained from, or viewed in, the office of the King County Department of Planning, King County Court House, King County Department of Buildings, County Administration Building, or the National Flood Insurer's Association has designated the Firemen's Fund American Insurance Company, 1000 Plaza 600 Building, 6th and Stewart, Seattle, as the servicing company for King County unincorporated areas.

water runoff accelerate. These problems are discussed in detail by Wooldridge in a paper prepared for the U. S. Department of the Interior.⁶ Here he discusses the kinds of impacts created by urbanization on hydrology and stream environment which include: (1) changes in timing of peak flow characteristics (such as accelerated runoff due to increase in impermeable area); (2) changes in volume of total runoff (principally due to changes in type of cover of the land, for example, forest versus paved surfaces); (3) changes in quality of water; and (4) changes in hydrologic amenities or stream environment (addition of man's waste products, eroded channels, algae growth, and the like).⁷ The costs of a typical complete storm water system are estimated to range between \$6,000 and \$14,000 per acre depending upon density and degree of urbanization. Major trunk systems alone cost an average of \$2,000 per acre.⁸ (based on 1967 dollar values in the Northwest construction

⁶ Wooldridge, David D., "Revised Objectives for Design of Urban Storm Water Systems in the Puget Sound Region," University of Washington College of Forest Resources and Institute of Forest Products, September, 1971.

⁷ Ibid., p. 13-17

⁸ Ibid., p. 21-22. Estimated cost by the City of Seattle for the Thornton Creek project averaged \$14,800 per acre for the 5,000 acre area within the Seattle City Limits.

for the National Flood Insurance Program, must review permit applications in regard to mud slide hazard and get a soils engineer report in doubtful circumstances.¹⁰

King County exercises control over excavation, grading and fill by regulating those cuts and fills involving more than 500 cubic yards of earth or other material on a single site or any excavation exceeding five (5) feet in vertical depth, or any fill exceeding three (3) feet in vertical depth. There are some listed exceptions to these general rules.¹¹

VALUE AND CONTRIBUTION OF STEEP SLOPES

Protection

The preservation of hazardous steep slope areas as open space can enhance the welfare and safety of County residents by protecting them from those hazards due to development. Areas included should be those subject to both erosion and landslide hazard as well as seismic, or earthquake hazard, to the extent that the latter can be identified.

⁹ For example, Bellevue and Renton.

¹⁰ National Flood Insurance Act of 1968, Part 1909, Subpart B, Section 1910.4 (a)(2).

¹¹ King County Code, Section 16.08.480

agencies.¹² The homeowner or developer incurs relatively greater costs in steep slope and other slope hazard areas. Because of the problems inherent in the hillside development, necessary or desirable controls are often required that further increase development costs.¹³ Excessive costs to the general public can be avoided through prohibition or careful control of development on steep slopes. These controls, in turn, may be a blessing in disguise to the private entrepreneur if potential problems can be avoided.

Scenic Value

Steep slopes and ravines, particularly when adorned with verdant vegetation are a scenic delight in and of themselves. They provide breaks in the landscape, bands of green that the eye can follow, identifying features that may supplement or strengthen a valley or stream feature. They provide relief and change from urban or strictly

¹² A discussion of the costs and problems of development in the steep slope areas of Los Angeles is contained within an article in the October, 1959, issue of House and Home Magazine.

¹³ Clark, Robert A., Hillside Development, Planning Advisory Service Report No. 126, ASPO, September 1959.

recreation

Where slopes are extremely steep, their value for recreation may be limited except for their contribution to a visual recreation experience or as buffers to other recreation uses within a park. However, the lineal character of many slopes lends itself to the development of trail systems, either within or immediately adjacent to them. These trails may be supplemented with picnic areas, rest stops and viewpoints, provided that they are designed sensitively within the land's capability. Existing features or conditions may allow opportunity for nature study, observation of geologic process and history, or other features indigenous to a particular site.

Greenbelts

In King County, steep slope areas have provided natural greenbelt buffer areas between different types of land uses. This is particularly noticeable in the Lower Green-Duwamish Valley, where agricultural, and increasingly industrial, uses occupy the valley floor as opposed to the residential and business uses on the adjacent plateaus.

Where these natural barriers can be capitalized upon for their values as insulators and separators, they should be

controls should provide for minimum disruption and maximum possible rehabilitation.

Water Retention and Quality

The natural vegetative cover that exists on most steep slopes in the County acts as a natural sponge to absorb a portion of excess water runoff. To the extent that this vegetation can be retained, or that denuded slopes can be replanted, such areas contribute to storm water control. In addition, vegetated slopes absorb and filter pollutants associated with runoff from urban area development. Where this runoff would eventually end up in a stream, lake or underground aquifer utilized for water supply, recreation or aquatic life, this filtering process is of significant value. Many small streams have their origin in spring and seep areas which are often associated with steep slopes. These important water resource areas can easily be damaged resulting in reduced water quality.

Wildlife Habitat

The presence of songbirds, small mammals and other wildlife within urban areas adds to the interest and variety of urban living. Since many birds contribute to insect

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observation.

GOAL AND POLICY FORMULATION

Goal

To retain and protect those slopes and ravines that constitute a hazard to development and contribute to the open space system of the County.

CRITERIA AND POLICIES FOR PRESERVATION OR PROTECTION OF STEEP SLOPES

Because steep slopes occur in a wide variety of locations and vary considerably in their characteristics, some general criteria guidelines are needed to aid in determining when and how they should be preserved for open space as opposed to development control. Suggested criteria are presented with the recognition that these may be modified and improved with use. Such criteria by themselves are not a guarantee of open space preservation or protection, and must be supplemented by adequate implementation measures. It is the intent that these criteria and policies shall apply equally to both public and private property and that the County, in particular, should provide a good example in the administration and use of its own properties.

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A. Preserve in open space uses those slopes and ravines:

1. That are hazardous or unsuitable for development by reason of any of the following conditions:¹⁴
 - a. Over 40% slope
 - b. Severe or very severe landslide hazard
 - c. Any other severe hazard as subsequently identified and documented.
2. That are important as parts of or as linkages between the parks and recreation system of the County (see Trails and Parks Plans).
3. That serve as buffers between incompatible land uses (e.g., residential versus industrial).
4. That perform a clear function as an identifier or delineator of urban form (such as community separators or connectors.)
5. Where there are year-round streams with existing or potential fish value (identified by State Department of Game or Fisheries).

¹⁴ Maps generally delineating these areas are located in the Office of Community Development, King County Court House. See also Appendix A for sources of information and description of soils constituting varying degrees of erosion and landslide hazard.

habitat function (as identified by persons knowledgeable in the specific field).

8. That contribute significant scenic value to the general public (e.g., the slopes along the Upper Green River Valley).

B. Preserve in open space uses to the greatest extent feasible when appropriate those additional steep slope and ravine areas:

1. That are moderately hazardous or unsuitable for development, as follows:¹⁵
 - a. Where slope is from 25-40%, the specific circumstances should be carefully reviewed.
 - b. Moderate landslide hazard.
 - c. Severe to very severe erosion hazard.
2. That have potential value as linkages in the County's total open space system.
3. Where desirable to retain as part of the natural drainage system of the County.
4. That perform an identifiable and desirable scientific, recreational, educational, or wildlife habitat function.
5. That are pleasing in terms of scenic value to the general public.

¹⁵ Ibid.

develop and other lands with a slope of from 16%-25%.

IMPLEMENTATION POLICIES AND ACTIONS

- A. Dedication of steep slope and other slope hazard areas should not only be accepted, but be encouraged, by the County through such means as:
 - 1. Encouraging the use of planned unit development and platting procedures where such land can suitably be made a part of the required open space.
 - 2. Providing information to property owners regarding available income or estate tax deductions.
- B. Development rights for that portion of tax title land which is steep slope or slope hazard areas should be retained in the public domain.
- C. Property owners of steep slope or slope hazard area lands that substantially meet the intent of the local criteria should be encouraged to file for tax relief under the current use assessment law.

be extended to all sections of the County as rapidly as feasible.

- F. Knowledge, including maps, regarding areas that are considered to be hazardous to development should be made readily available to developers, property owners, lending institutions, realtors and others who are either potential users of these areas or are in a position to influence those users.
- G. Continue to utilize existing available funds and seek additional matching funds to acquire full fee or partial ownership rights to as much trail and park lands as appropriate and possible within steep slope and slope hazard areas.
- H. Where it is not feasible, or appropriate, to permanently retain slope hazard areas (as enumerated in 'B-1,' of the Criteria) in open space, the following types of action should be followed:
 - 1. In processing subdivision or building permit applications, developers will be required to submit evidence regarding soil or geologic problems and how these are to be overcome.

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public or private actions that would damage or destroy
steep slopes.

* * *

APPROVED BY THE ENVIRONMENTAL DEVELOPMENT
COMMISSION AND RECOMMENDED TO THE KING
COUNTY EXECUTIVE, COUNCIL, AND DEPARTMENT
OF COMMUNITY AND ENVIRONMENTAL DEVELOPMENT,
LAND USE MANAGEMENT DIVISION, JANUARY 25,
1973.

2/9/73/mjl

LANDSLIDE HAZARD

Very Severe (based on known occurrences of slides)

Sources: Seattle Times Newspaper Reports
Seattle Engineering Department
Bellevue Planning Department
Puget Sound Governmental Conference
(insurance map and Open Space Report No. 10)
King County Department of Public Works
Mercer Island City Public Works Department
Redmond Planning Department
State Highway Department, District No. 7
State Department of Natural Resources,
Slide and Slippage Records for Washington
Seattle Urban Design Report "Determinants of
City Form," page 4.

Severe

AkF (Alderwood and Kitsap Soils, Very steep)
This undifferentiated group is composed of Alderwood
gravelly sandy loam and Kitsap silt loam soils
occurring on slopes from 25% to 70% throughout the
County. Proportions of the soils vary greatly with-
in short distances. Area-wide there are about 50%
Alderwood Soils and 25% Kitsap Soils. In addition to
the Alderwood and Kitsap Soils, there are about 15% of
very deep moderately coarse textured soils (unnamed),
and 10% very deep coarse textured soils (Indianola).

Drainage and permeability in this mapping unit varies as
indicated for the various soils. Runoff is rapid to very
rapid.

KpD (Kitsap silt loam, 15% to 30% slopes)
This soil is similar to Kitsap silt loam, 2% to 8%
slopes, but occurs on moderately steep slopes, and the
platy substratum generally is near 40 inches.

Inclusions - up to 15% of gravelly sandy loam soils with
consolidated substratum (Alderwood); up to 15% of very
deep sandy soils (Indianola), and up to 2% poorly drained
mineral and organic soils (Bellingham, Seattle and Tukwila).
Total inclusions do not exceed 30%.

¹ Except for areas of very severe landslide hazard, the data is based
on soils information contained in Soil Survey, King County Washington
1970, Preliminary Report. U.S. Dept. of Agriculture Soil Conservation
Service

drained soils (Bellingham, Norma, and Seattle Series) occur in depressions. Soils of the Beausite and Oval series with substrata of sandstone and andesite respectively amount to 25% of this mapping unit in some places, especially on Squak Mountain, the Newcastle Hills, and north of Tiger Mountain. Total inclusions do not exceed 30%. Runoff is medium.

KpC (Kitsap silt loam, 8% to 15% slopes)
This soil is like Kitsap silt loam, 2% to 8% slopes, except it is strongly sloping. Areas have similar shapes, are much less extensive, and commonly are smaller than 50 acres. It has about the same kind and amount of mapping inclusions. Runoff is medium.

EROSION HAZARD

Severe to Very Severe

AkF and AgD (see descriptions under LANDSLIDE HAZARD)

BeD (Beausite gravelly sandy loam, 15% to 30% slopes)
This soil is similar to Beausite gravelly sandy loam 5% to 15% slopes, except that it occupies slopes of 15% to 30%. Short slopes occur in some places, but mostly they are long; and mapped areas exceed 40 acres. This mapping unit has about the same kinds and amounts of mapping inclusions as Beausite gravelly sandy loam, 6% to 15% slopes, except that on the eastern side of Squak Mountain, south of Issaquah, and the north slopes of Tiger Mountain, east of Issaquah, some slopes are as steep as 50%. Runoff is rapid.

BeF (Beausite gravelly sandy loam, 40% to 75% slopes)
Soil similar to above (detailed description not included here) but on steeper slopes. Runoff is very rapid and erosion hazard is very severe. Areas range in size from 100 to about 600 acres.

KpD (see description under LANDSLIDE HAZARD)

RaD (Ragnar fine sandy loam, 15% to 25% slope)
This soil is like Ragnar fine sandy loam, 6% to 15% slopes but is on long, narrow, moderately steep terrace fronts between terraces or adjacent to streams with slopes of 15% to 25%. Areas range in size from 5 to

Inclusions - up to 20% of very gravelly soils (Everett), up to 15% of gravelly sandy loam soils with consolidated substrata (Alderwood) and up to 10% of silt loam soils with laminated substrata (Kitsap).

Rh (Riverwash)

Riverwash consists of long, narrow areas of sand, gravel and stones along channels of the larger streams. These non-agricultural areas are either barren of vegetation or support a scattering of cottonwood, willows and other trees and shrubs. They are frequently overflowed and altered by severe erosion and deposition.

REFERENCES

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Project Open Space Report No. 10, Landslide Hazardous Areas in the Central Puget Sound Region, Puget Sound Governmental Conference, November, 1964.

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Marion Langstaff of the King County Department of Planning provided the technical assistance and wrote the draft report for the Conservation Committee.

Special acknowledgement for suggestions on the report go to Max Fullner, Soil Conservation Service, United States Department of Agriculture, and Eugene Dziedzic, State Department of Game.

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